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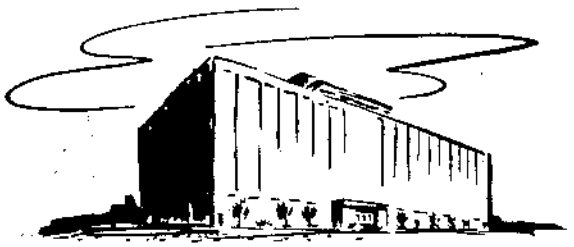

NAVAL RADIOLOGICAL DEFENSE LABORATORY

1968

San Francisco, California 94135

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CHAPTER I

1968: NRDL BECOMES OF AGE

FORMAL 21ST ANNIVERSARY ON 2 FEB.

2 February 1968 marked the formal 21st anniversary of NRDL, when its mission was first defined. It stated that "The immediate aim is to provide adequate scientific facilities to fully exploit the opportunities for technical investigations offered by the vessels participating in Operation CROSSROADS." Today, this $15,000,000 Laboratory, recognized internationally as a major research institution, has an impressive record of scientific achievement. NRDL maintains close association with the operating forces of the Navy and the other Armed Forces to ensure the proper integration of the results of Laboratory research for direct use in military operations.

CYCLOTRON PROGRESS

Another milestone in the development of the NRDL AVF Cyclotron was reached the week of 12 February when a series of graphs of actual beam probe measurements were taken. Of particular interest was the graph which showed the differential probe measurements and indicated an excellent orbital separation. On 25 April a beam was circulated into extraction channel and through the main magnet yoke onto an external viewing screen.

TITLE IS "COMMANDING OFFICER"

The title of the official in command of NRDL was changed effective 3 June to Commanding Officer from Commanding Officer and Director.

CAPT FICK ASSUMES COMMAND

CAPT Donald C. Campbell, USN, was relieved of command of NRDL by CAPT Theodore R. Fick, USN, on 30 August in a ceremony in the Auditorium. A 1945 graduate of the U. S. Naval Academy, CAPT Fick came to NRDL from the Boston Naval Shipyard where he served for five years: from September 1963 - June 1966 as Planning and Estimating Superintendent and then as Planning Officer and Industrial Management Assistant. Other assignments for CAPT Fick included duty aboard LSM-133; LSMR-513; LST-1138; CV-45; Mare Island Naval Shipyard; Staff, Com-ServRon-Three; Staff, ComServPac; and Division of Reactor Development. A native of Bremerton, Washington, CAPT Fick attended the University of Washington in Seattle for one year prior to entering the Navy. He also attended MIT postgraduate school for Naval Engineering and Nuclear Engineering degrees and Boston University where he earned a master's degree in Business Administration in 1967. While attending Boston University, CAPT Fick was initiated into the Alpha Chapter of Beta Gamma Sigma, a scholastic honorary society.

LEGION OF MERIT TO CAPT CAMPBELL

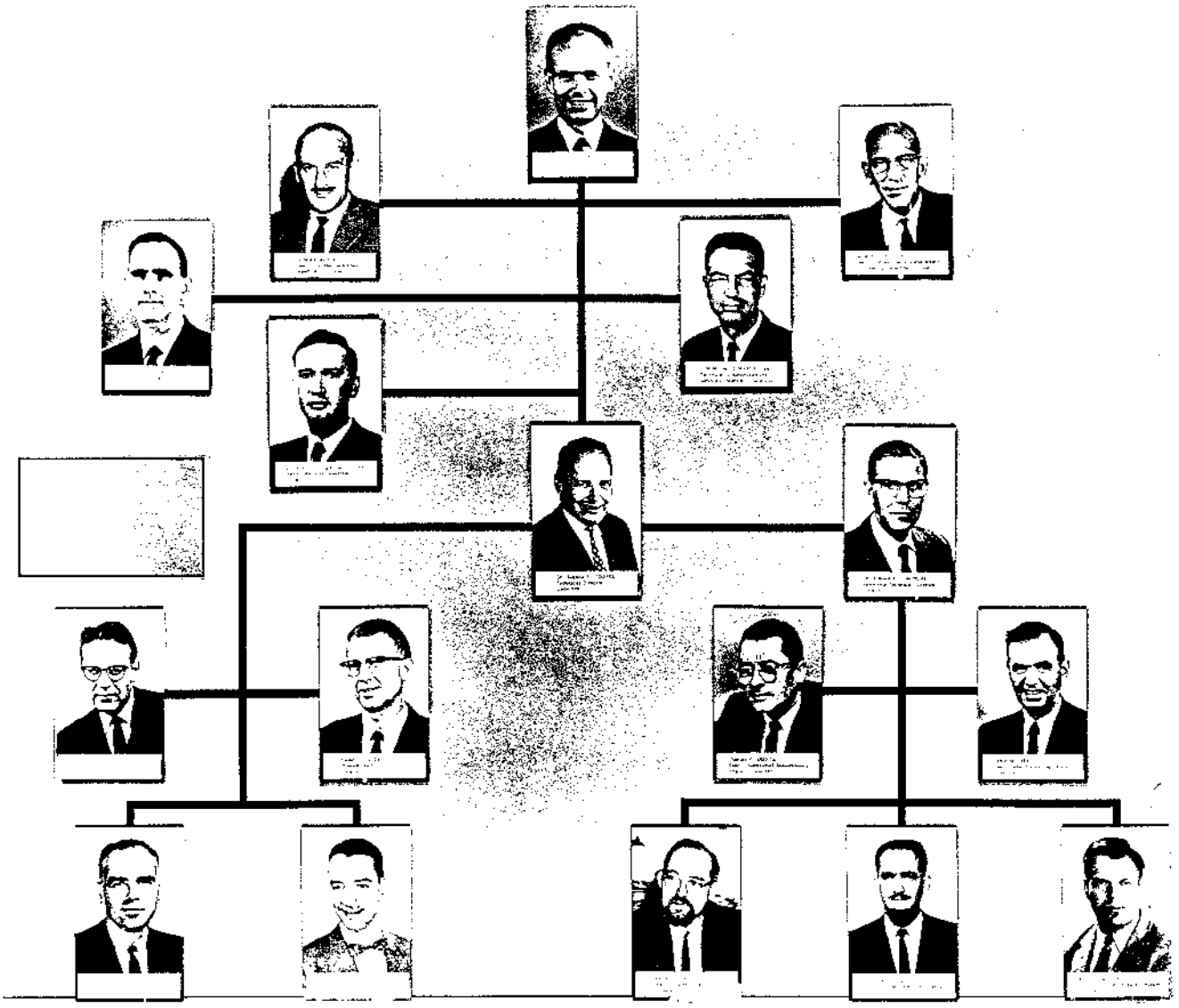
CAPT Campbell was presented a Legion of Merit medal at the 30 August Change of Command ceremony. This award, given for exceptionally meritorious conduct in the performance of outstanding services, was presented by CAPT F. A. Hooper, NAVSHIPS 03. The citation read: "The President of the United States takes pleasure in presenting the Legion of Merit to CAPT Donald C. Campbell, USN, for exceptionally meritorious service from July 1963 to September 1968 as Commanding Officer, Naval Radiological Defense Laboratory...displaying inspiring leadership and outstanding skill as a scientist and engineer, CAPT Campbell has directed the Laboratory efforts to serve more effectively the needs of the Navy...Through his untiring professionalism he guided the Laboratory through the transition from field testing of nuclear devices to high quality laboratory experimentation and simulation necessitated by the treaty banning nuclear tests in the atmosphere, and in even more difficult transition from the gathering of fundamental information about the phenomenology of nuclear events to the application of such information to military problems..." CAPT Campbell retired from the Navy after a career of 27 years of distinguished commissioned service. He accepted a position at Lockheed's Missile and Space Division, Sunnyvale, as Senior Staff Engineer.

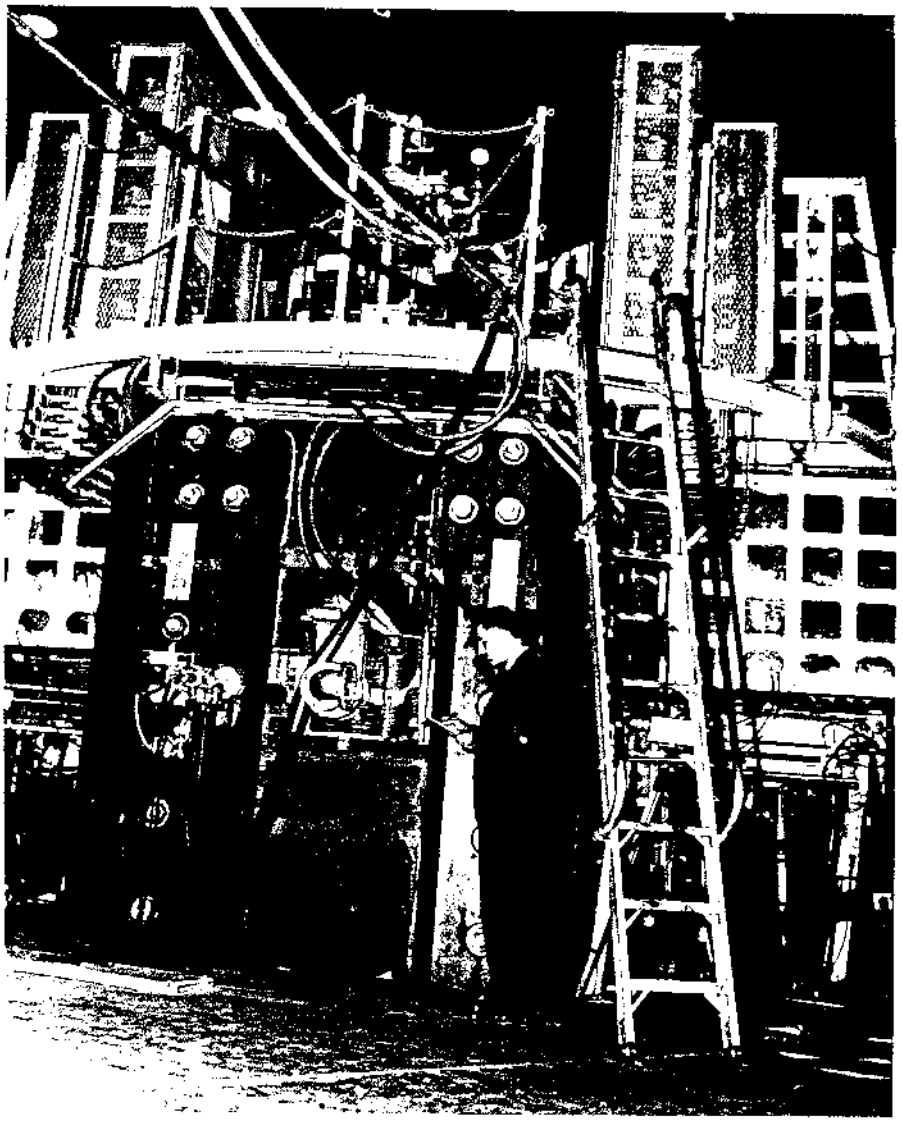
MISSION

There was no formal alteration in the mission during 1968. However, the Laboratory research program started to move in the direction of one

CAPT THEODORE R. FICK, USN, assumed command of NRDL on 30 August 1968.

CAPT DONALD C. CAMPBELL, USN, is shown wearing a LEGION OF MERIT medal presented to him the day he relinquished command of NRDL and retired from the Navy after a career of 27 years of distinguished commissioned service.





Dr. D. J. Horen, Head of Accelerator Branch, checks extraction port on new Naval Radiological Defense Laboratory cyclotron.

of the three alternatives recommended to the Chief of Naval Material by the five-man study group that looked into the future direction of NRDL during the latter part of 1967. This alternative and a mission is as follows: "To prosecute a fundamental and applied science program in nuclear, biological, and chemical warfare, and in non-weapon nuclear energy applications. This includes analysis, research, development, test, evaluation, system integration and fleet engineering support. Where appropriate to the mission, to conduct investigations in related fields of science and technology."

On 12 January NRDL was designated lead Navy laboratory for research and development on nuclear weapon effects and on B/C warfare.

NRDL BOARD OF VISITORS DISESTABLISHED

The NRDL Board of Visitors, established in 1966, was disestablished in 1968. The Naval Research Advisory Committee established five laboratory Advisory Boards. The Research Board will include NRDL, NRL, and NELC with Professor William G. Shepherd, University of Minnesota, as chairman.

REORGANIZATION

There was little change in the NRDL organization in 1968. The most important change occurred in the Technical Management Office, Code 908. With the addition of responsibilities for Long Range Planning & Nuclear Warfare Technology coordination for the Laboratory, the code was reorganized as follows effective 1 May: 908 - Technical Planning and Management Office; 908-A Long-Range Planning Group; 908-B - Nuclear Warfare Technology Planning Group; 908-C - Defense Systems Technical Management Group; 908-D - Nuclear Systems Technical Management Group.

Because of the addition of BW/CW programs, the functions of the Nuclear Technology Division were rewritten, and Physical Chemistry Branch, Code 935, was changed to the BW-CW Branch, Code 935, on 1 July.

The Comptroller and Management Engineering Department was reorganized to enable it to assume responsibility for data processing in accounting and payroll from the San Francisco Bay Naval Shipyard on 1 July. A new branch was formed for accomplishing business data processing and other branches were renumbered: 140 - Comptroller and Management Engineer; 141 - Management Analysis Staff; 142 - Financial Control Staff; 142-A - Budget Branch; 142-B - Accounting Branch; 142-C - Payroll Branch; 143 - Management Data Processing Staff.

An organizational chart, current at year's end, appears on the next page.

RADIOLOGICAL CONTROL TEAM

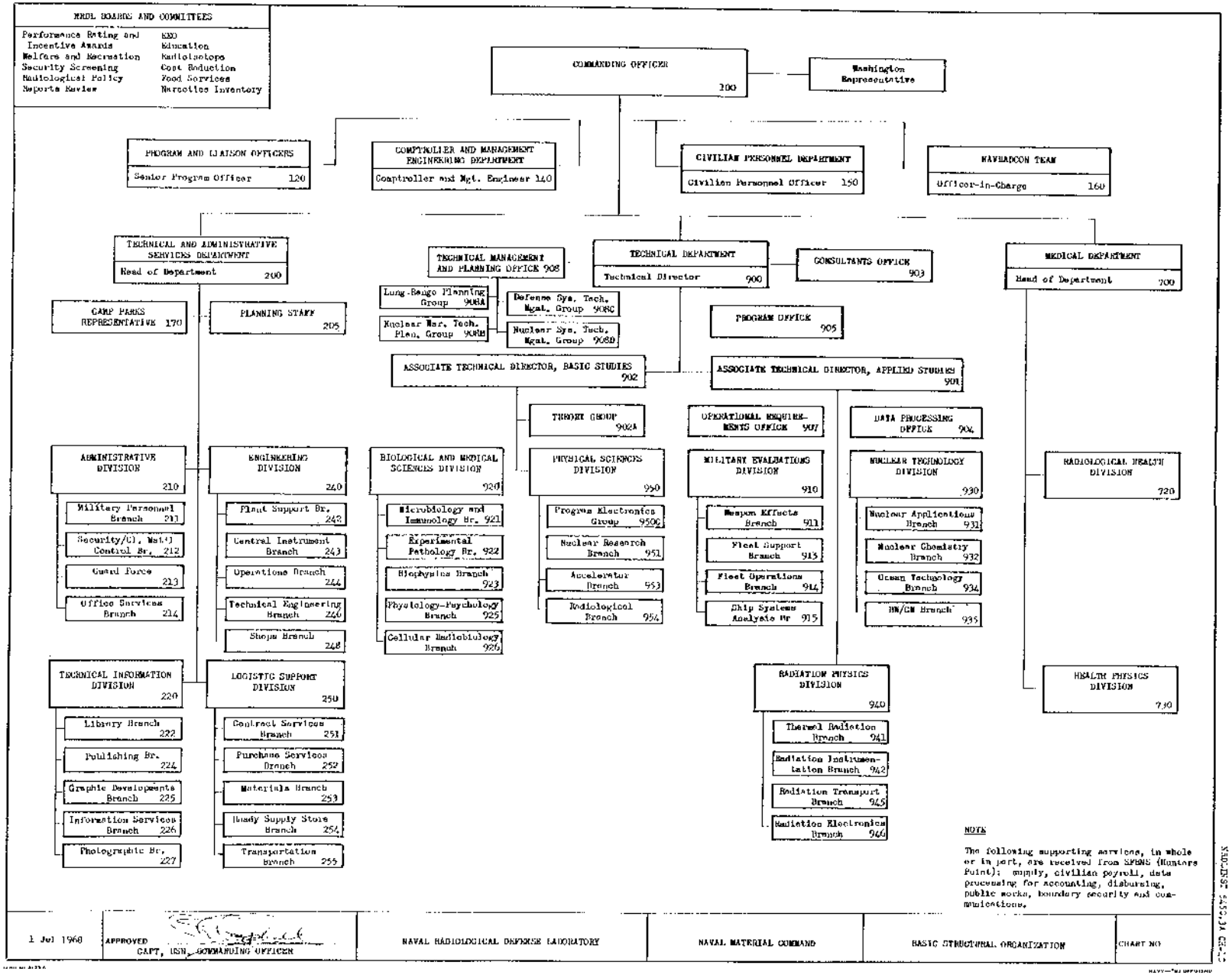
The NRDL Radiological Control team, one of two in the Navy, was formed to provide, upon request of higher authority, on-the-scene forces at radiological accident sites with expert advice and technological assistance.

On 1 May 1968 CDR W. E. Campbell, Jr., USN, Senior Program Officer, was assigned collateral duty as Officer-in-Charge of the NAVRadcon team, replacing CDR N. J. Davis.

A series of training program lectures and demonstrations, designed to acquaint team members with the functions of others on the team, was conducted under the supervision of Mr. A. L. Smith, Head, Health Physics Division.

15 CONSULTANTS

During 1968 there were 15 consultants under contract to the Laboratory. They are: Fire Research - Dr. A. Broido, Chief Scientist, U. S. Forest Service, Pacific Southwest Forest and Range Experiment Station. Lipid Metabolism - Dr. C. Entenman, Director, Institute for Lipid Research, Berkeley. Radiation Effects & Hazards - Dr. R. D. Evans, Professor of Physics, MIT. Theoretical Physics - Dr. R. J. Guiolio, Assistant Professor of Physics, University of San Francisco. Immunology - Miss J. A. Grieshaber, Research Assistant, Stanford University. Radiological Information Systems - Dr. K. K. Harris, Research Scientist, Lockheed. Dosimetry - Dr. H. H. Heckman, Physicist, Lawrence Radiation Laboratory. Hydrodynamics - Dr. M. Holt, Professor of Aeronautical Science, University of California. Nuclear Physics - Dr. H. P. Holz, Associate Professor of Physics, University of Missouri. Accelerator Physics - Dr. B. D. Kern, Professor of Physics, University of Kentucky. Radiation Biology - Dr. D. J. Kimeldorf, Professor of Radiation Biology, Oregon State University. Operations Research - Mr. L. L. Lapin, Assistant Professor of Management, San Jose State. Electron Microscopy - Dr. T. L. Phillips, Associate Professor, U. C. Medical School. Pathology - Dr. V. J. Rosen, Associate Professor, U. S. C. Medical School. Kinetics of Reactor Systems - Mr. V. I. Schrock, Associate Professor of Nuclear Engineering, University of California.


NRDL BOARDS AND COMMITTEES
Performance Rating and Incentive Awards
Welfare and Recreation
Security Screening
Radiological Policy
Reports Review
EEO
Education
Radioisotope
Cost Reduction
Food Services
Narcotics Inventory
COMMANDING OFFICER 100
Washington Representative
PROGRAM AND LIAISON OFFICERS
Senior Program Officer 120
COMPTROLLER AND MANAGEMENT ENGINEERING DEPARTMENT
Comptroller and Mgt. Engineer 140
CIVILIAN PERSONNEL DEPARTMENT
Civilian Personnel Officer 150
NAVHADCON TEAM
Officer-in-Charge 160
TECHNICAL AND ADMINISTRATIVE SERVICES DEPARTMENT
Head of Department 200
CAMP PARKS REPRESENTATIVE 170
PLANNING STAFF 205
TECHNICAL MANAGEMENT AND PLANNING OFFICE 908
Long-Range Planning Group 908A
Nuclear War. Tech. Plan. Group 908B
Defense Sys. Tech. Mgmt. Group 908C
Nuclear Sys. Tech. Mgmt. Group 908D
TECHNICAL DEPARTMENT
Technical Director 900
CONSULTANTS OFFICE 903
PROGRAM OFFICE 905
MEDICAL DEPARTMENT
Head of Department 700
ASSOCIATE TECHNICAL DIRECTOR, BASIC STUDIES 902
ASSOCIATE TECHNICAL DIRECTOR, APPLIED STUDIES 901
TRIGA GROUP 902A
OPERATIONAL REQUIREMENTS OFFICE 907
DATA PROCESSING OFFICE 904
ADMINISTRATIVE DIVISION 210
Military Personnel Branch 211
Security/Cl. Matl. Control Br. 212
Guard Force 213
Office Services Branch 214
ENGINEERING DIVISION 240
Plant Support Br. 242
Central Instrument Branch 243
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Technical Engineering Branch 246
Shops Branch 248
BIOLOGICAL AND MEDICAL SCIENCES DIVISION 920
Microbiology and Immunology Br. 921
Experimental Pathology Br. 922
Biophysics Branch 923
Physiology-Psychology Branch 925
Cellular Radiobiology Branch 926
PHYSICAL SCIENCES DIVISION 950
Program Electronics Group 950C
Nuclear Research Branch 951
Accelerator Branch 953
Radiological Branch 954
MILITARY EVALUATIONS DIVISION 910
Weapon Effects Branch 911
Fleet Support Branch 913
Fleet Operations Branch 914
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NUCLEAR TECHNOLOGY DIVISION 930
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Nuclear Chemistry Branch 932
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RADIOLOGICAL HEALTH DIVISION 720
TECHNICAL INFORMATION DIVISION 220
Library Branch 222
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Graphic Developments Branch 225
Information Services Branch 226
Photographic Br. 227
LOGISTIC SUPPORT DIVISION 250
Contract Services Branch 251
Purchase Services Branch 252
Materials Branch 253
Ready Supply Store Branch 254
Transportation Branch 255
RADIATION PHYSICS DIVISION 940
Thermal Radiation Branch 941
Radiation Instrumentation Branch 942
Radiation Transport Branch 945
Radiation Electronics Branch 946
HEALTH PHYSICS DIVISION 730
NOTE
The following supporting services, in whole or in part, are received from SPSNS (Hunters Point): supply, civilian payroll, data processing for accounting, disbursing, public works, boundary security and communications.
1 Jul 1968
APPROVED
CAPT, USN, COMMANDING OFFICER
NAVAL RADIOLOGICAL DEFENSE LABORATORY
NAVAL MATERIAL COMMAND
BASIC STRUCTURAL ORGANIZATION
CHART NO

PERSONNEL CHANGES AND STATISTICS

A number of reduction-in-force actions caused by ceiling restrictions and cuts in funding resulted in a significant lowering of the staffing level by year's end. The permanent staff totalled 542 at the beginning of the year and 502 at the end. The quit rate was 13.9% and the accession rate 5.5%. Quit rate for professionals was 7.8% and accession rate 2.0%. Of the total of 74 separations 24 were directly attributable to RIF action.

The average employee's use of sick leave rose from 59 to 67.5 hours. Average grade level rose very slightly from 9.66 to 9.75.

Academic degrees now held by the staff total 137 bachelors, 70 masters and 60 doctorates.

The 1968 summer program included five faculty members, eight graduate students and nine undergraduates.

MILITARY

On 5 January CDR. M. M. EDWARDS, Jr. reported aboard and assumed duties as Director of Technical and Administrative Services.

In February LT M. H. ZARLENGO transferred to COMTWELVE pending PEB proceedings.

On 29 March LT S. C. HALLETT transferred to NAVSTA, Norfolk, Va. CDR EDWARDS assumed her duties as Head of the Administrative Division as a collateral duty.

In May CDR N. J. DAVIS, Jr., transferred to the USS WASP for duty; LT F. J. BERLANDI was released to inactive duty and LT L. K. VINSON reported aboard for duty.

In June LTJG R. I. WALKER and ENS G. A. BULLANO reported aboard for duty and LT P. C. BLOCK was released to inactive duty.

In July LCDR W. W. MILLER, LCDR H. R. HILGARD, LCDR A. L. WILEY, Jr., LT J. D. EARLE and ENS W. H. FOWLER reported aboard for duty and LT C. G. BURRIS was released to inactive duty. On 15 July LCDR T. R. BIRDWELL transferred to NAVHOSP, Charleston, S.C., for duty. LCDR C. D. GURI assumed his duties as Head of the Medical Department.

On August 31 CAPT D. C. CAMPBELL, Commanding Officer, retired. CAPT T. R. FICK, who reported aboard 24 August, assumed command. Also in

August LCDR J. P. BIRD transferred to Oceanographic Unit One; LT F. A. HODGE transferred to NROTC Unit, Oregon State University; LT J. L. ELZIE was released to inactive duty and LTJG W. A. O'HARA reported aboard for duty.

On 12 October LT M. M. LOSER reported aboard and assumed duties as Military Personnel Officer and Communications Officer. On 26 October LCDR GURI was released to inactive duty. LCDR WILEY assumed his duties as Head of the Medical Department.

In November LTJG S. B. HOLOMAN and LTJG F. A. WENSLAWSKI were released to inactive duty.

In 1968 there was an average of 24 Naval Officers assigned to NRDL with five other service officers assigned. Additionally, there were five clinical clerkships (1915) officer personnel aboard during the year. There were 6 officers transferred and 12 officers received for duty throughout the year. There was one officer retirement; 7 officer separations and 8 officer promotions.

Enlisted personnel aboard in 1968 averaged 25. There were 19 enlisted transfers and 25 enlisted receipts. Five enlisted men were separated; one reenlisted; three extended their enlistments and three signed agreements to extend their enlistments.

YOUTH PROGRAMS

This was the fourth year of organized youth programs at NRDL. Seventeen youths participated in the Youth Opportunity Campaign during the summer. Eleven are continuing in the President's Back-to-School Program during the school year. In addition, during the summer work experience was provided for five youths in the Neighborhood Youth Corps. All were given orientation training, counseling and on-the-job training in a wide variety of occupational fields. The benefits of work experience in an atmosphere such as the Laboratory provides coupled with counseling and training were clearly evident. Nearly all participants were motivated to return to or continue their educations.

FACILITIES

70-INCH AVF CYCLOTRON

As reported on Page 1 the first extracted beam was obtained on the

70-inch cyclotron on 25 April. Work continued on completion of the beam transport system and on beam development and diagnostics.

Basically, the facility is a four sector AVF cyclotron with small gap and dees in the valley of the magnet pole face. Some of the unique features are: (1) The cyclotron is on a gun mount and can be rotated approximately 330° for easier accessibility and alignment with targets; (2) there are two sets of magnet hill iron shims, one for acceleration of protons up to about 65 MeV and the other for the energy region from 65-95 MeV (the hill shims can be changed without disturbing the main vacuum); (3) the beam extractions system consists only of magnetic components, and (4) one of the target locations will provide for large exposures, i.e., several square meters.

RESEARCH ANIMAL FACILITY

The Animal Facility, completed in 1967, was brought to full utilization in 1968 by solving the sterilization autoclave problems.

CAMP PARKS

Certain reductions in the Camp Parks field facility activities were accomplished in 1968 and more were planned for 1969. The remaining facilities and operations at Camp Parks at the end of 1968 were:

1. Nucleonics radiation range.
2. Large animal grazing areas.
3. Hot cell.
4. UC and SRI (contractor) plant contamination research.
5. Motor vehicle maintenance.
6. General maintenance.

In 1968, a Fire Research Project was initiated for burning certain excess buildings at Camp Parks under conditions which would allow the researchers to learn more about mass building fires. Negotiations were underway for burning other excess buildings under the same conditions.

ENVIRONMENTAL TEST FACILITY AT SAN CLEMENTE ISLAND

AEC requirement for environmental tests of marine and terrestrial SNAP systems led to a continued expansion of NRDL's underwater test facility off San Clemente Island. SNAP subsystems were installed in free water and on the bottom to depths of 130 feet. Operating characteristics corrosion studies and fuel solubility studies constituted the major effort at the site in FY 1968.

CHAPTER II

TECHNICAL PROGRESS AND ACCOMPLISHMENTS

Technical progress and accomplishments at NRDL during 1968 are reviewed in this Chapter, as in the 1967 History, on a cross-sectional basis. Beginning with operations research studies reflecting operations/systems analysis type work directly applicable to specific fleet problems, this Chapter also covers highlights of research in the various areas of biology and medicine, physical-radiochemistry, electronics, dosimetry, and radiation and particle physics.

Owing to security considerations, a number of significant classified studies performed as'quick response' to Navy requests are only partially reflected in this History. In 1968 these 'quick response' investigations, requiring in-depth literature reviews, systems analysis research, computer oriented studies and state-of-the-art surveys, constituted some 30% of the operations research. Increasing requests from a number of Navy and other Department of Defense sponsors were directed to NRDL scientists and engineers now considered authorities in many areas of nuclear science. Some of these studies rapidly assumed stature as major end-products of this Laboratory.

WEAPONS EFFECTS MODEL STUDIES AND OPERATIONS RESEARCH

Study of nuclear cloud phenomena, specifically on relative motion and coagulation of particles in a turbulent gas, showed that theory of turbulent-accelerative particle motion, relative to fluid and coagulation, may be extended to particles whose relaxation times are greater than period of microscale eddies. Assistance was provided OP-97 with

proposal evaluation and contractor selection on SABMIS...FORTRAN IV computer program was developed to estimate exposure-rate history and total exposure to an unshielded radiation detector moving in a straight line at constant speed and depth through a stratified radioactive pool which is expanding and being dispersed and distorted by constant ocean currents...Data was developed for assessment of expected frequency for random deposition of nuclear power (SNAP) units on land and in various ranges of ocean depths as related to latitude of impact...Research on exposure of man's skin, lungs and gastrointestinal tract to radioactive debris particles, 1 to 1000 μ in dia., from nuclear-powered aerospace vehicles as a result of re-entry burnup or self-destruct resulted in mathematical models for analysis of exposure of skin, lungs and GI tract ...Fundamental processes of ignition and combustion relating to fires caused by nuclear weapons were reviewed in depth as part of a program for assessing urban vulnerability to fire from such bursts...A system for conflagration assessment of urban areas developed for OCD was applied to establish relative conflagration potential of various sections of San Jose, Calif. and Albuquerque, N. M. and to delineate probable fire-breaks...It was found that overall mass fire scaling in conjunction with local mass fire scaling and flame experiments can be used to determine street environment required for civil defense planning...A high-density absorbing smokescreen appears feasible as a means of preventing thermal ignitions following a nuclear attack...It appears there is greater probability for controlling an urban mass fire by creating and maintaining firebreaks and letting the fire burn out than by trying to extinguish it...Analytical and graphical methods were developed to assist in determination of optimal search area to examine in looking for the radioactive patch of water formed in an underwater nuclear explosion...Completed development from theoretical model of a computer program labelled DELFIC which describes theoretical bases of a land-surface burst nuclear cloud-rise model...Radioactive fallout from nuclear explosions at ocean surface was predicted for four standard-atmosphere climatic conditions, and intensities were shown to be much lower than those for land-surface bursts of same yields...Developed computer model for calculating both external and internal dose from passing radioactive cloud that might result from an uncontrolled release of activity to air, ground and ocean environments...Quantitative estimates were derived of prompt and delayed radiation among troops in foxholes when subjected to nuclear air bursts ...Fallout ingress through windows or other apertures was shown not likely to be significant problem in most U. S. fallout shelters...Study of San Joaquin Valley showed ecological balance maintained in many agricultural communities may be seriously affected by effect of ionizing radiation from nuclear fallout on insect populations...Target Vulnerability Studies concepts and analyses, developed for possible application to Navy installations, were applied to proposed city or community models ...Developed nuclear weapon burst electromagnetic pulse signature

characteristics for post-detonation diagnosis of burst parameters and weapon characteristics...Delineated radiation hazards to submarine crews from nuclear explosions...Developed ship vulnerability methodology to assist in the CNO (OP-96) ASW Force Level Study using the NRDL Ship Vulnerability Model to provide input data...Performed a study of the feasibility of a land-based ballistic missile intercept system (SABMIS)... Published Vol. I of the reports on the Military Operational-Environmental Simulation and Information Collating System (MOESAICS), an overview of the system and discussion of its prototype...A simple method was developed for graphical prediction of shielding factors for various gamma ray energies in various ship locations...An operationally valid anti-air warfare model was prepared for detailed examination of naval operational problems and requirements in a nuclear environment...Quantitative estimates were derived for prompt casualties and delayed radiation casualties among troops in foxholes subjected to nuclear air bursts...Ship shielding protection provided to the crews of USS BAINBRIDGE (DLGN-25) and USS HORNE (DLG-30) was described...Shielding factors were developed for USS NIMITZ (CVA(N)-68).

BIOLOGICAL AND MEDICAL RESEARCH

Incidence of variations in rhythm of heart beat in rats was shown to increase with age...Irradiation with low doses of ultraviolet light during first 30 minutes after end of synchronizing treatment was found to delay division of synchronized Tetrhymena pyriformis (Strain W)...Chromosome studies in irradiated mice indicated that, following high sub-lethal whole-body exposure, regeneration of reticular tissues occurs in a clonal fashion...Bee venom and its melittin fraction were shown to generate antibacterial activity against penicillin-resistant strain of Staphylococcus ...A "test tube" biological method capable of matching compatible donors and recipients for skin or kidney transplants was developed and evaluated ...Food restriction was shown to retard development or manifestation of glomerulo-sclerosis, considered to be a direct radiation effect on kidney ...Determined that for rats receiving sublethal (acute) dose of fast neutrons, exposure as a juvenile is most detrimental, while irradiation late in life is least effective...When radioactive particles are in contact with skin, ulcers which fail to heal will be produced if there is a sufficiently large dose over a certain minimum area, and, if serious ulcers are produced, skin cancer as a late effect is likely...Lethal dose $(LD)_{50/30}$ for swine, sheep, goats, burros, and dogs was found to be in range of 280-350 rad, measured in air, with bilateral fallout-field

type exposure...Investigated vascular structure of skin of four breeds of swine under study to evaluate some aspects of radiation response of swine skin...Studied injury accumulation in sheep and swine at exposure rates of 0.5-4R/hr over a total exposure range of 100 to 700 R...Rate of injury accumulation at 4R/hr in swine appears to be lower than in sheep... Found that irradiation has detrimental effect on resistance of rats to cold exposure...Determined that alterations of amount and kind of bile acids produced by liver following irradiation could markedly affect metabolism of bile acids and lipids by liver...For a situation represented by an instantaneous release of ^{90}Sr-oxide into ocean, a model of biotic radiocontamination was devised, based on known characteristics of marine organisms...An antigen elimination method was used to evaluate radiation injury to immune system in mice as result of total-body irradiation and showed delay of onset of immune elimination and decrease in rate of appearance of antibodies in plasma...Elevation in deoxycytidine levels in rats following irradiation was demonstrated in both urine and blood and may be adaptable as a biochemical assay of radiation exposure in man... Carried out experiments to test suitability of planarian worms as model multicellular systems for studies of radiation injury and recovery... Studied differential sensitivity of peritoneal lymphocytes in mice to irradiation to see if there is correlation with their ability to produce antibodies in syngeneic recipients.

PHYSICAL-RADIOCHEMISTRY RESEARCH

Established that explosion products of CHASE V operation were contained below ocean surface layer...Five SNAP-19B electrically heated (simulating radioactivity heating) capsules were exposed to various ocean conditions to obtain data on interaction of radioisotope power device fuel and containment materials, components and systems with ocean environment...Determined that ocean bottom material adsorbed plutonium activity ...Electrochemical techniques were employed in corrosion measurements made on uncoated, emissively coated and thermally shocked uncoated specimens of Haynes 25 alloy in seawater and additional effect of erosion by ocean bottom material also was studied...Determined that water glass technique and tagging procedure developed at NRDL can be extended to sealing radioactivity into beach sands, providing carbonate materials are absent or removable...A Particle Activity Module Computer program was developed and used to test effect of certain parameters on fractionation of fallout...Obtained updated individual radionuclide data by an exhaustive review of literature...High-buoyancy, rapid-fill sampler for

rapidly sampling surface seawater from open sea by a fixed wing aircraft was developed and tested successfully for use in connection with the open ocean nuclear detonation search problem...Developed method for measuring condensation rates of vaporized MoO_3 onto liquid and solid oxide substrates in air at high temperatures...Beta dose rates, gamma spectra and decay of effluent particles from the PHOEBUS 1B EP-IV reactor test run at AEC's Nevada Reactor Development Station were measured...A first version computer code was developed and tested which solves incompressible, viscous, initial-value two-dimensional, axially symmetric fluid flow problems encountered in connection with an examination of detonation of a nuclear device far below sea surface...Completed DAEDALUS, a Gamma Exposure Rate Prediction Computer code for underwater nuclear bursts... Completed Vol. IV, Part 1, of an annotated compendium of data on radiochemical and radiation characteristics of fallout...Measured rates at which vaporized TeO_2 is taken up by molten and solid particles at high temperatures...Determined cumulative fission yield and half life of ^{134}Sb to be 0.32 ± 0.04 percent and 11.1 ± 0.8 sec., respectively... Two computer-compatible analyzer output media, punched cards and magnetic tape, were shown to be practical and appropriate for providing computer coupling for array of pulse height spectrometers...Prepared index of peaceful applications of nuclear explosives which have potential for Navy use...Experimental data was collected during test of Phoebus 1B EP-IV reactor at NTS showed inhalation and ingestion exposures well below permissible limits...Completed data analysis from HYDRA IIB series of underwater explosions off San Clemente Is. and final report on transfer and disposition of traced explosion products to column produced by shallow underwater explosions on sea bottom...Identified ^{117}Pd and determined its half-life and cumulative fission yield...Found that if seawater enters interior of SNAP-21 system, radiological hazard to man would not constitute a serious threat as fuel would remain contained for a relatively long period of time...Average reconcentration in four widely-spaced Pacific Ocean surface seawater samples was determined and half-life of ^{186}Re found to be 89.5 ± 0.2 hr.

ELECTRONICS RESEARCH

Evaluated semiconductor trends applicable to Navy electronic system design during the next 3 to 5 years...Parallel plate transmission line Electromagnetic Pulse (EMP) Test Facility was built and placed in operation...metal-oxide-semiconductor shields were shown experimentally to improve radiation resistance of transistors, but not by more than order

of magnitude...A method, based on avalanche theory, was developed for predicting primary photo-currents of silicon NPN planar and mesa transistors...Experimentally examined circuits, transistors and diodes in shipboard computers and peripheral equipment for vulnerability to transit radiation...Welded seal developed that offers some advantages in a recycling ionization chamber developed as detector for radiacs...In Feb., NAVELEX assigned NRDL full responsibility for portable radiacs for nuclear weapons effects measurements for Navy and Marine Corps from conception through procurement and final acceptance. An Operational Environment and Procurement Engineering Program was established to write technical specifications and provide NPO and DECASR with technical guidance for all such procurements.

DOSIMETRY

An LiF dosimeter was developed to measure gamma-ray exposures between 10^5 and 2 x 10^9R, utilizing responses of high temperature glow peak...Examined nature of electronic band structure of lithium fluoride in the hope that radiation response could be modified and to make it useful for a variety of dosimetry measurements...A criterion for design of better track recording cellulose nitrate was found and track registration criterion for polymeric material established. Close agreement was demonstrated between experimentally measured etched track lengths in many materials and calculated range-energy tables for a wide variety of particles and broad energy spectrum...A passive field dosimeter was developed and tested for making diagnostic measurements of radiation spectra at the Nevada Test Site.

RADIATION PHYSICS RESEARCH

Developed a method for solving energy balance equation for specimen's heat capacity, using heat capacity of pure gold as primary standard... Determined that a hyperbolic grid system for measuring propagation velocity of radio-frequency waves can be derived which would be capable of simulating radiation environments...Tactical radiation measurement system pitfalls, primarily errors due to calibration of radiac instruments in

a free-air point source geometry were calculated and identified...High-precision determinations of effects of pile bombardment and subsequent thermal treatments upon thermoelectric properties of semiconductors showed that promising materials must be examined individually rather than as classes, since results vary considerably...Designed, constructed and employed a system consisting of pyrolysis chamber and gas chromatography unit to analyze degradation products of white alpha-cellulose in study of fires resulting from nuclear attack...Used time-of-flight mass spectrometer to analyze blow-off-gases produced by thermal decomposition of carbon phenolic and pyrolytic graphite ablators...Two models were developed which gave satisfactory fits to available angular data for calculating diminishment by roughness above a rough surface covered with fallout particles as compared to a smooth surface...Developed a new neutron-induced activity prediction system for use in amphibious operations which is designed to predict radiation hazard on beaches exposed to neutrons from a nuclear weapon...X-ray generator, based on a hemispherical diode (named "Spherex") with an integral Blumlein, was found to be the most promising method of generating sharp, high-intensity pulses of X radiation with photons primarily in 70 to 100 Kv range, 50 nanoseconds duration and giving 1 calorie/cm^2 at test specimen...A semirad detection system for high intensity neutron radiation was developed, designed, constructed and successfully tested... Shielding properties of two tantalum-aluminum laminar slabs for X rays with energies above and below K-edge energy of tantalum were investigated with dosimeters and good comparisons obtained with results from Monte Carlo calculations.

PARTICLE PHYSICS

Simple, direct and accurate methods for charge and mass determination of heavy charged particles were devised...Neutron optical model parameters and inelastic scattering cross sections for Na, Mg, Al, Si, S, Ti, Cr and Fe were recalculated...Differential cross sections for 10 gamma rays from the n, n', γ reaction of 2.8 MeV neutrons of Si, Ti, Cr, and Fe were measured...Investigated and defined cross sections for production of secondary gamma rays produced by neutron inelastic scattering to permit calculation of radiation fields produced by nuclear weapons... The NRDL-AVF cyclotron was essentially completed and started up...First internal circulating beam of 3.5 MeV protons having good quality and characteristics was measured...External beam extraction was obtained on 25 April...Peeler-regenerator concept of beam extraction is working... Extraction channel is being modified to effect higher particle fluxes... Beam characteristics studies were continued.

TECHNICAL PLANNING AND MANAGEMENT

By direction of the Director of Navy Laboratories (DNL), NRDL was delegated the responsibility for the formulation and coordination of integrated Navy Nuclear Weapon Effects Research programs. As the initial task under this responsibility the NRDL Technical Planning and Management Office formulated and published a FY 1970 Navy-Wide Nuclear Warfare Technology Program. A preliminary NWT program for FY 1971 was also prepared and readied for Navy-Wide coordination. The TP&M Office continued to provide R&D program management and technical advisory services to the Office of Civil Defense, Advanced Research Projects Agency, AEC Space Electric Power Office, AEC Space Nuclear Propulsion Office, AEC Division of Reactor Development and Technology and Naval Air Systems Command. Program managed funds totaled approximately $3.6 million of which 45% supported in-house research.

Programs for which management and technical advisory services were provided included: (1) OCD Radiological Protection, Thermal and Fire Protection, Radiological Monitoring Systems, Emergency Medical Research, Fire Effects and Protection, Radiological Phenomena and Effects, Radiological Countermeasures, Postattack Medical, Health and Welfare Operations and Physical Environment Studies; (2) ARPA Underwater Nuclear Explosion On-Site Inspection; (3) ACDA Field Test FT-15; (4) AEC-SEPO Environmental Response and Effects; (5) AEC-SNPO Radiological Effects; (6) AEC-DRD&T Environmental Effects and Test Program for marine and terrestrial SNAP sources; (7) NavAir Ocean Surveillance Data Interpretation, and Electro-Optical Reconnaissance Systems; (8) NavElex-Ship Recognition Data Base, and (9) NMC-LOC Surveillance Feasibility Studies.

CHAPTER III - PUBLICATIONS

REPORTS AND MEMORANDA

In 1968 technical publications production at NRDL reached a total of 271 documents. In 1967 the total was 331; 1966, 327. The previous three years, somewhat lower, were: 1965, 291; 1964, 213; and 1963, 144.

A breakdown of the 1968 reports by types shows:

Technical Reports (NRDL-TR).....	139
Computer Reports (NRDL-CR).....	2
Reviews and Lectures.....	11
Progress Reports.....	20
Technical Manuals.....	3
Letter Reports.....	90
Technical Reports Contractor (TRC).....	3
Technical Reports Externally published (TRX).....	3
Total.....	271

PUBLICATIONS IN THE OPEN LITERATURE

In the open literature, 37 NRDL authors had articles appearing in 25 journals, representing a broad spectrum of scientific disciplines.

BOOKS PUBLISHED

* Mr. Raymond S. Alger, Head, Thermal Radiation Branch, authored a new book entitled "Electron Paramagnetic Resonance: Techniques and Application", published by Interscience Publishers. The title page credited Ichiro (Chick) Hayashi, Graphic Development Branch, with the illustrations.

* Dr. Victor J. Rosen, NRDL Consultant and Associate Professor, U. S. C. Medical School, and Mr. Leonard J. Cole, Head, Experimental Pathology

Branch, are the authors of "Radiation Induced Renal Lesions in the Rodent," a chapter in "Methods and Achievements in Experimental Pathology, Volume 4, 1968, S. Karger and Co., Basle, Switzerland.

* Dr. C. Sharp Cook, Head, Radiation Physics Division, was a contributing editor to the Fourth Edition of Van Nostrand Scientific Encyclopedia published in 1968. He prepared the entries on nulcear science and nuclear engineering.

* Dr. E. C. Freiling, Head, BW/CW Branch, and Mr. M. H. Rowell, Nuclear Applications Branch, are the authors of "Ion Exchange in Molten Systems," Chapter 2 of "Ion Exchange, No. 2 in a Series of Advances," Marcel Dekker, 1968.

* Dr. C. M. Huddleston, Technical Planning and Management Office, is co-author of the chapter on "Ducts and Voids in Shields -- Attenuation of Gamma Rays," in "Engineering Compendium on Radiation Shielding, Vol. 1, published by Springer-Verlag, 1968.

PATENT ACTIONS

Starting in mid-1968 NRDL's Patent Representative reported directly to Washington rather than through ONR Pasadena as in the past. He is Charles D. B. Curry, Patent Counsel, ONR, San Francisco Area Office. Paul N. Critchlow, who was NRDL's Patent Representative for many years, is now Patent Counsel, ONR, Pasadena, shifting from a similar position at the Navy Electronics Laboratory Center, San Diego.

Two patents were issued: (1) Inventors: Messrs. L. A. Perrine, H. A. Zagorites and M. I. Lipanovich, "Nuclear Radiation Detector Comprising Multiple Ionization Chamber with Hemispherical-Shaped Electrodes," Patent No. 3,366,790, issued 30 January 1968. (2) Inventors: Messrs. E. R. Schleiger and N. Goldstein, "Apparatus for Thermally Measuring Absorbed Radiation Doses," Patent No. 3,394,258, issued 23 July 1968.

Patent disclosures authorized for filing during 1968 totaled seven: (1) Inventors: LCDR C. D. Guri, Dr. K. F. Swingle and Mr. L. J. Cole, "Biochemical Method for Determining Radiation Dose Exposures." (2) Inventors: Dr. E. V. Benton and Messrs. R. F. Henke and N. Collver, "A Method for Mass and Charge Determination for Cosmic Ray Particles." (3) Inventors: Messrs. N. Goldstein, W. G. Miller and E. Tochilin, "Lithium Fluoride for Megarad Dosimetry." (4) Inventors: Messrs. R. H. Heiskell and L. E. Egeberg, "High Buoyancy, Rapid Fill Water Sampler." (5) Inventors: Messrs. R. N. Anderson and N. A. Parlee, "Nuclear Fuel Reprocessing Process for Nitride Precipitation." (6) Inventor: Mr. B.

A. Euler, "A Versatile Large-Memory Pulse-Height Analyzer for Gamma-Ray Spectrometry." (7) Inventors: Miss J. F. Fennell and Messrs. W. H. Shipman and L. J. Cole, "A New Antibacterial Polypeptide Fraction Derived from the Bee Venom, Active Against Penicillin-resistant Staphylococcus."

There were 20 patent applications pending, and 17 patent disclosures under development.

CHAPTER IV

AWARDS - COMMENDATIONS - HONORS

SUPERIOR CIVILIAN SERVICE AWARD TO FREILING

Dr. Edward C. Freiling, Head, Physical Chemistry Branch, received a Superior Civilian Service Award on 28 May at a major awards ceremony in the Auditorium. This award, highest that may be granted to a civilian by the Naval Material Command, recognized Dr.Freiling's major contributions to research on characteristics of nuclear fallout, particularly his comprehensive studies in fractionation on which he is an internationally acknowledged authority. Dr. Freiling came to NRDL in 1951 immediately after receiving his Ph. D. degree in chemistry at Stanford.

MERITORIOUS CIVILIAN SERVICE AWARD TO ZIGMAN/RAINEY/SULIT

At the 28 May ceremony Mr. Paul Zigman, Head, Technical Planning and Management Office, was presented a Meritorious Civilian Service Award (the highest that may be made at Laboratory level) for the excellent way he organized and coordinated broadly-based research activities, especially for the Office of Civil Defense. Mr. Zigman has worked at NRDL since 1948 with the exception of 18 months during 1960-61 when he was with Atomic International at Canoga Park. He earned a B.S. degree in chemistry at UCLA in 1948.

On 15 August Meritorious Civilian Service Awards were presented to Mr. Sam Rainey, Head, Military Evaluations Division, and Mr. Robert Sulit, Head, Ship Systems Analysis Branch. The awards to Messrs. Rainey and Sulit were based on the effective studies produced under their guidance for the Naval Ship Engineering Center which will have a fundamental and significant impact on the posture of the Navy of the future...most significant was the development of the Military Operational Environmental Simulation and Information Collating System (MOESAICS) concept...Their

contributions to the Tripartite Information Exchange Project IEP ABC-25 have been recognized and appreciated by the United Kingdom and Canadian participants.

GOLD MEDAL FOR PRITCHETT; SILVER TO SWINGLE/GURI

Based on outstanding Scientific Achievement during calendar year 1967, on 28 May 1968 a Gold Medal was presented to Mr. John W. Pritchett, Ocean Technology Branch, and Silver Medals went to Dr. Karl F. Swingle and LCDR Charles D. Guri, MC, USNR, Experimental Pathology Branch. This was the first time since the Gold/Silver Scientific Achievement program started in 1960 that an award was made to a military investigator...also to two members of the same Branch in the same year.

Mr. Pritchett was cited for producing solutions to previously intractable problems of incompressible fluid flow, with particular application to underwater explosions, through very original adaptations of some techniques of advanced computer technology.

Dr. Swingle's award was earned for elucidating the specific enzymatic and biochemical bases of one of the earliest and most fundamental post-radiation tissue lesions, namely the degradation of chromosomal deoxyribonucleoprotein with mammalian lymphoid cells.

LCDR Guri was recognized for developing a new biochemical procedure for quantitative determination of deoxycytidine levels in rat blood -- a technique which can detect radiation doses up to 100 R, and which is potentially applicable as a radiation dosimeter in man.

DOD JOINT SERVICE COMMENDATION MEDAL TO MAJOR TIFFANY

Also at the 15 August awards ceremony, Major Russell Tiffany, Marine Corps Liaison Officer, received a Department of Defense Joint Service Commendation Medal based on his meritorious service from July 1966-June 1968 at Sandia Base, Albuquerque, New Mexico, as an Instructor, National Capabilities Division, Nuclear Training Directorate, Field Command, Defense Atomic Support Agency.

THREE NAVY COMMENDATION MEDALS PRESENTED

During 1968 Navy Commendation Medals were presented to CDR MAURICE M. EDWARDS, Jr., USN, Technical and Administrative Services Director, MAJOR ROBERT F. MILLIGAN, USMC, Marine Corps Liaison Officer, and MAJOR

NORBERT P. PAGE, USAF-VC, former Air Force Liaison Officer and Research Veterinarian.

CDR Edwards' award, presented 1 March, was based on meritorious achievement while serving with the U. S. Naval Support Activity in Saigon Repair Department.

Major Milligan, who received his award on 7 August, made significant contributions in the liaison capacity of interpreting and projecting Marine Corps development requirements to military and civilian investigators pursuing research applicable to the Marine Corps. As Senior Scientific Investigator, he made significant contributions to Laboratory research directly applicable to current and future combat operations, particularly development of combat simulation and data retrieval procedures and development of a concept for practicable battlefield navigation system for ground combat troop use which can contribute to the solution of critical battle field position location navigation problems.

Major Page, at AEC Headquarters since 1967, was presented his award on 12 February by CAPT D. C. Campbell, Commanding Officer and Director, in the Office of Brigadier General Edward Giller, USAF, Director, Division of Military Applications, AEC, Washington, D. C. The award was based on Major Page's service at NRDL from 1963-67. He carried out a series of research projects on the effects of radiation from nuclear weapons that has provided the basis for a new set of exposure guidelines of great importance to military operational commanders and planners.

SCIENTIST-IN-RESIDENCE PROGRAM

NRDL's 15th and 16th Scientists-in-Residence arrived during 1968: Dr. Richard Wistar, Jr., on 1 July, and Dr. Edward F. Gibson on 3 September. Dr. Wistar left on 1 November to enter the Army as a Captain, stationed at Walter Reed Hospital. During four months at NRDL Dr. Wistar worked in the Experimental Pathology Branch, extending his experimental work on the biochemistry and genetics of the immunoglobulins in inbred strains of rats. For the past three years Dr. Wistar was in Melbourne, Australia, a Helen Hay Whitney Fellow at the Walter & Elizabeth Hall Institute of Medical Research, studying antibody structure and the genetics of immunoglobulins. Dr. Gibson is working in the Accelerator Branch. As a post-doctoral research associate in the Physics Department at the University of Oregon the past two years, Dr. Gibson did research in experimental nuclear physics making use of the 4-MeV Van de Graaff facility.

The Scientist-in-Residence Program was established in 1960 to assure a fresh input of ideas at NRDL by scientists of stature brought here for a year or two to conduct research in their fields of competence. Of the 16 participants to date, one came from Canada; three, England; one, Germany; one, Japan; one, Netherlands; one, Sweden; and eight, U. S.

ISRAELI PHYSICIAN HERE

Dr. Ammon Ben-David, physician in the Israeli Defense Force, worked "in residence" in Bio Med's Experimental Pathology Branch for two months during Spring 1968. He was briefed on pertinent unclassified biomedical research activities and shown some specific laboratory techniques, such as bone marrow transplantation in irradiated dogs, tissue culture techniques involving tissue transplantation immunity, and in vitro cellular immunological reactions. Dr. Ben-David had just completed one year at the Albert Einstein College of Medicine in New York as Research Associate doing experimental work in immunology. On return to Israel, he expected to be placed in charge of the Blood Bank and Tissue Preservation Department of a large government hospital and to be coordinator of all medical-military related research in the Surgeon General's Office.

WORLD WHO'S WHO IN SCIENCE LISTS SIX NRDLERS

The first edition of WORLD WHO'S WHO IN SCIENCE is a biographical dictionary of all scientific disciplines from antiquity to the present. Six NRDLers are listed: Dr. E. L. Alpen, Head, Bio-Med Division; Dr. N. E. Ballou, Head, Nuclear Chemistry Branch; Mr. L. J. Cole, Head, Experimental Pathology Branch; Dr. C. Sharp Cook, Head, Radiation Physics Division; Dr. E. R. Tompkins, Associate Technical Director; and Dr. Herbert Weiss, Nuclear Chemistry Branch.

Two former NRDLers also listed were Dr. D. J. Kimeldorf, at NRDL from 1948-67 and now Professor of Radiation Biology at Oregon State University, and Dr. Peter Nowell, 1954-56 and Summer 1965, now Professor of Pathology, School of Medicine, University of Pennsylvania.

DR. SILVERMAN AT BROOKHAVEN ON NRDL FELLOWSHIP

Dr. Myron S. Silverman, Head, Microbiology and Immunology Branch, received a one-year appointment to Brookhaven National Laboratory as Research Coordinator in the Medical Department, starting 9 September on a NRDL Fellowship. Dr. Paul H. Chin is Acting Head during his absence. Dr. Silverman will conduct research with Dr. Eugene P. Cronkite on transplantation immunity in animals given extracorporeal irradiation.

RANDOM HONORS

Appointment - Dr. Myron S. Silverman to the Editorial Advisory Board of RADIATION EFFECTS, a new international journal scheduled to begin publication around January 1969.

Listed in new edition of AMERICAN MEN OF SCIENCE - Robert A. Sulit, Head, Ship Systems Analysis Branch.

Letter of Appreciation was presented to HMC H. E. Williams in June, signed by the Commanding Officer, Headquarters Support Activity, Taipei, Republic of China for Chief Williams' part in saving lives and alleviating suffering when a Civil Air Transport passenger jetliner crashed near Shu Linkou on 16 February 1968. Chief Williams came to NRDL in May and is Assistant in the Radiological Health Division.

Career Day Staff Job "Well Done" - The services of the two NRDLers who were members of the 1967-68 Federal Career Day Staff, Dr. J. P. Hurley and Dr. Roger Caputi, were praised by the Director of the Civil Service Commission, San Francisco Region, Mr. A. T. Briley, in a letter to the Commanding Officer.

GENERAL AWARD

There were nine Superior Achievement Awards made for a total cash value of $1,485, and 15 Sustained Superior Performance awards totaling $2,100.

Outstanding Performance Ratings were granted to six employees, including the Technical Director, Dr. E. P. Cooper. Quality Step Increases went to 40 NRDLers during 1968.

Beneficial Suggestions received totaled 38, with 11 adopted for a cash value of $320. Eight patent actions (disclosures and issuances) were awarded for a total of $1,050.

Thirteen civilians were presented retirement pins upon completion of their careers at NRDL. It is worthy to note that the first NRDL employee to gain the distinction of 40 years with the Federal Government was Guard Supervisor Nelson Craft, Jr., who retired at 42 years.

Thirty-year pins went to six employees and twelve NRDLers were presented 20-year pins.

Military awards included four Navy Good Conduct Medals and three National Defense Service Medals.

CHAPTER V

SEMINARS - SYMPOSIA - CONFERENCES

MANAGEMENT DEVELOPMENT PROGRAMS

The first 1968 Management Seminar was held on 4 January with four speakers as follows: "Mission Study," Dr. E. P. Cooper, Technical Director;"Organizational Relationships," CAPT D. C. Campbell, USN, Commanding Officer; "NIF," Mr. R. D. Wilson, Comptroller & Management Engineer, and "The Computation Situation," Dr. E. R. Tompkins, Associate Technical Director.

Management Seminars over the past years have placed some emphasis on changes in philosophy and direction in the Navy in Washington. Continuing this program, on 7 June RADM T. B. Owen, USN, Chief of Naval Research, presented a seminar to Lab Management. He traced Federal Government emphasis on science since Sputnik then narrowed into recent problems with justification and funding of RDT&E in DOD and Navy.

On 29 October CAPT Eli Roth, USN(Ret.), NRDL C. O. & Director 1960-63 and now Manager of the Field Operations Office, Weapons Evaluation Control Bureau, Arms Control & Disarmament Agency, Washington, D.C., explained "Operation First Look." This five-month field exercise in Southern England, conducted jointly by the U. S. and the United Kingdom, was concerned with how accurately one nation can assess another in the control of conventional armament and aircraft. NRDL aided in installation and maintenance of unmanned multi-sensor kits as well as automatic reduction of data from kits.

TECHNICAL DIRECTOR'S COLLOQUIUM

Dr. Roger Preston, of the U. C. Radiation Laboratory, Livermore, presented a Technical Director's Colloquium on 5 June. His subject was

"Underground Nuclear Weapon Testing." From February-May 1947 Dr. Preston, then an active duty Navy Lieutenant, was NRDL's first Officer-in-Charge.

Professor G. Rahe, Professor of Electrical Engineering at the Monterey Postgraduate School, Monterey, presented a Technical Director's Colloquium on 26 June. His subject was "The NPGS Hybrid Computer."

OTHER INTERNAL SEMINARS

Technical Department Program Reviews continued in 1968, as well as Seminars at Branch, Division, and Department levels. Many of them were presented by NRDLers, others by specialists from other government agencies, industry, or universities. Speakers from foreign countries included: Dr. Henry McIlwain, University of London (England), on 19 February; Dr. G. W. Barendsen, Radiobiological Institute of the Organization for Health Research, Rijseijk, The Netherlands, on 27 June; and Dr. Avinom Zlotnick, Hadassah Medical School, Hebrew University, Jerusalem, Israel, on 25 October.

MEETINGS AT NRDL

The Ship Systems Command NBC Program Review was held at NRDL on 11-14 March...NWER Review, 26-27 March...Information exchange of those interested in a definition of necessary RDT&E in order for air systems to operate and perform their missions in a nuclear warfare environment, 28-29 March..

A DASA-sponsored conference was held at this Laboratory 9-11 April - theme: "Basic Radiobiology Studies: Relevance to Man in the Nuclear Age"...Approximately 100 Medical Officers, active and inactive, of the 12th Naval District attended a Symposium here on 11-12 April on "Medical Aspects of Nuclear, Biological and Chemical Warfare Defense"...15th meeting of the Interservice Incapacitating Agent/Weapons Systems Subcommittee of Joint Technical Coordinating Group met here on 24-25 April.

A two-day Radiac Symposium, initiated at the request of CNO, was held at NRDL on 8-9 May...Subcommittee on Fallout Advisory Committee on CD/NAS, 11 July...NAVSHIPS B/C Warfare, 24-26 July...DASA working group, 30 July...NWE Electronics Interactions Working Group, 8-9 August...Radiation Emission Transport and Shielding Group, 8-9 August...Semi-annual meeting of the DASA Fallout and Residual Radiation Working Group, 3-4 Oct...Fall 1968 meeting of the West Coast Navy Laboratory Directors' Council, 4 Oct...Inter-Laboratory Committee of Editors and Publishers, 10-11 Oct...JTCG Binary Subcommittee, 7-8 Nov...Navy Research Library Council, West Coast, 7-8 Nov...DASA Working Group, 11 Dec.

NRDL-OCD-ARRANGED FIRE RESEARCH CONTRACTORS CONFERENCE

NRDL conducted the 6th Annual Office-of-Civil-Defense Fire Research Contractors Conference at Asilomar on 21-25 April. As in prior years, the conference was directed and arranged by Dr. M. G. Gibbons. Subject matter was in progress and results of some 29 OCD-sponsored fire research projects currently being managed by NRDL. Among the 44 participants were representatives from the Canadian Emergency Measures Organization and the Australian Defense Research Laboratories.

ACTIVE ROLES IN THIS COUNTRY AND ABROAD

Again in 1968 a large number of NRDLers took an active role in numerous meetings throughout this country that concerned operations research analyst, physicists, life scientists, mathematicians, chemists, and engineers.

Meetings abroad in which this Laboratory took an active part included: (1) Ottawa, Canada, 27-28 Feb. - first meeting of a group officially known as The Working Panel on the Physics of Nuclear Radiations of the U. S. - U. K. Canadian - Australian Nuclear Weapons Effects Subgroup of The Technical Cooperation Program. The panel contains about 25 members from the four countries. Dr. James Ferguson, Nuclear Research Branch, is the NRDL representative. (2) London, England, 14-17 May - 2nd Tripartite Conference on NBC-at-Sea. Dr. E. P. Cooper, Technical Director, was one of the 10 U. S. representatives. (3) Interlaken, Switzerland, 26 May - 1 June - Symposium on Radiological Protection of the Public in Nuclear Mass Disaster, sponsored by the International Radiation Protection Association. The conference chairman, Capt. S. B. Pretre, worked at NRDL from January-July 1966 while in the U. S. for one year at the invitation of the U. S. Government. He is now with the Research Institute for Protective Construction in Zurich, Switzerland. Dr. C. Sharp Cook, Head, Radiation Physics Division, presented two papers, and two other NRDLers presented a paper - Dr. George Leong, Head, Cellular Radiobiology Branch, and Dr. J. D. Teresi, Military Evaluations Division. (4) Toronto, Canada, 10-13 June - Annual Meeting of American Nuclear Society. Mr. Leroy Haggmark, Radiation Transport Branch, chaired the session on "Gamma Ray Sources and Transport"; and Dr. C. Huddleston, Technical Planning and Management Office, presented a paper. Other NRDLers who participated were Dr. W. E. Kreger, Head, Physical Sciences Division, and Dr. R. D. Kubose and Mr. H. Goya, Nuclear Applications Branch.

SIGMA XI CLUB OF NRDL

Officers for 1968 were Dr. Edward Freiling, president; Mr. Ray Alger,

president-elect; and Miss Muriel Johnston, secretary-treasurer.

The Annual Dinner Meeting of the NRDL Sigma Xi Club was held at Veneto's restaurant in San Francisco on 27 January. Dr. Arthur F. Kip, Professor of Physics at the University of California, spoke on the subject "The Meaning of Academic Freedom."

The Annual Spring Lecture of the NRDL Sigma Xi Club was held on 2 April in the Auditorium. Professor Thomas T. Holme, a 1967-68 National Lecturer for the Society of the Sigma Xi and its affiliated society, the Scientific Research Society of America, spoke on "Produce and Compete or Perish." Dr. Holme is Professor of Industrial Engineering at Yale University.

The annual business meeting was held on 3 December with Mr. Alger moving up to the presidency for 1969, and Mr. Clay P. Butler selected as president-elect. Miss Johnston will finish out her two-year appointment as secretary-treasurer during 1969.

CHAPTER VI - TRAINING

CIVILIAN PERSONNEL

Only one NRDL Fellowship was granted during 1968. Dr. Myron S. Silverman began a one year residence at Brookhaven National Laboratory. Mr. Lloyd Shaw, Miss June Brevdy, and Mr. Norman Alvares completed their resident studies at U. C., Stanford, and Minnesota, respectively. Former Fellow Eugene V. Benton received his Ph. D. from Stanford. Mr. Billy T. Lee received a master's degree in mechanical engineering from Stanford under the Laboratory Educational Support Program.

One hundred and twenty-five staff members participated in various technical and management courses during 1968. The Civil Service Commission Regional Training Center provided such courses as Basic Supervision, Management Techniques, Equal Employment and Middle Management as well as Executive Institutes. The Army accomodated four members of our professional staff in their course on Personnel Management for Executives. Four others attended the UCLA Leadership Laboratory. Labor Relations Seminars, Middle Management Institutes, and Training Administrators Seminars provided by ROCMM were also utilized.

OFFICER PERSONNEL

Two officers attended an Industrial Security Course at Ft. Holabird, Maryland; two attended a Registered Publications Systems Course at San Diego; two attended a Nuclear Safety Officer Course at North Island, Calif., and one attended a Nuclear Hazard Training Course at DASA, Sandia Base, N. M. One officer completed a Civilian Manpower Management Field Institute at San Francisco and one completed a Naval Correspondence Course on Security of Classified Information and Personnel Administration. There were six Active Duty for Training officers attached to the Laboratory at various intervals throughout the year. There were 67 sets of Officer TAD orders issued and one USAFI Course ordered.

ENLISTED PERSONNEL

Four enlisted personnel attended an Audio-Visual Projectionist Course at the Presidio; one attended the BUPERS Mess Management Training School at Treasure Island; one attended the NBC School, Nuclear Phase, at Treasure Island, and one attended a course on operation of Mark IV and Mark VIII Bird Ventilation equipment at Allied Therapy, San Francisco. There were 9 sets of enlisted TAD authorizations issued. There were three USAFI courses ordered for enlisted personnel. There were 19 enlisted examinations given for advancement in rate with five subsequent advancements and five were to be advanced after the first of the new year. Three enlisted personnel attended local colleges or universities throughout the year for part-time out-service training. Three hours of in-service training were conducted weekly throughout the year with an average attendance of 22 men per class or approximately 90% participation for the year.

CHAPTER VII - VISITORS

During 1968 10,677 people were cleared to visit NRDL. The largest single month was May with 1,117 visitors, trailed closely by April with 1,104. Breakdown of the total visitors by classification shows that approximately 40% were professional personnel, or 4,286; outside sales and services, 3,462; San Francisco Bay Naval Shipyard services, 1,233; personal guests, 597: interviews, 246; tours, 222; meetings, 557; and foreign nationals, 74.

Many distinguished scientists and high ranking military officers visited NRDL throughout the year. A few were the Honorable M. Carl Walske, Jr., Assistant to Secretary of Defense (Atomic Energy); Dr. William W. Carter, Assistant Director, Defense Research Engineering (Nuclear Programs); Dr. Joel S. Lawson, Jr., Director of Navy Laboratories; Brigadier General A. J. Armstrong, USMC, Director, Development Center, Marine Corps Development & Education Command, Quantico, Va.; Major General Louis Metzger, USMC, Assistant Chief of Staff, RD&S, Headquarters, Marine Corps; Brigadier General Regan Fuller, USMC, Commanding General, Force Troops, Pacific; RADM Frank B. Voris, MC, USN, Assistant Chief of BuMed for Research and Military Medical Specialties; VADM P. D. Stroop, USN(Ret.), DNL Advisory Group; RADM Leo B. McCuddin, USN, COMI2; former NRDLer Walmer E. Strope, Assistant Director for Research, OCD; Dr. G. K. Hartman, Technical Director, Naval Ordnance Laboratory; Dr. Al Jankowitz, Chief Scientist, Office, Strategic Offensive and Defensive Systems, CNO-OP-97; Professor Robley D. Evans, MIT, Consultant and former member NRDL Board of Visitors; Dr. Melvin H. Heiffer, Walter Reed Institute; Dr. R. K. Jones, Lovelace Foundation; Dr. Lee E. Farr, Department Public Health, Berkeley; and CDR Scott Carpenter, the first U. S. astronaut/aquanaut.

Foreign visitors included: AUSTRALIA - Dr. D. W. Posener, Commonwealth Scientific Industrial Research Organization. CANADA - Fred A. Christie, Armament R&D Establishment of Defense Research Board. ENGLAND - Dr. Ernest R. Buckle, London University Imperial College; Surgeon CDR C. O. Hughes, Royal Navy, Headquarters, Royal Naval Radiological Protection Service, Ministry of Defense, London; CAPT M. Beeching, RN, CO,

HMS Phoenix; CDR C. L. Jordan, RN, Trials Commander, HMS Phoenix; CDR Edward G. S. Walker, RN, Staff Officer British Navy Staff, Washington, D. C. FRANCE - Dr. Emilia Frindel, Institute Gustave Roussy. GERMANY - Dr. Theodor Fliedner, Institute Hematology, GSF Assoc. w/Euratom, Frieburg; Dr. J. Kramer, Physical Technical Bundesanstalt, Bundesalle Institute. INDIA - Janakiraman Ramachanbran, Bombay (presently at U. C. Medical Center). ISRAEL - Dr. Saul Patai, Hebrew University. ITALY - Dr. Vincenzo Covelli, Centro di Studi Nucleari Della Casaccia, Rome. JAPAN - Dr. Tetsuo Noguchi, Government Industrial Research Institute, Nagoya; Dr. Kenjiro Yokoro, Hiroshima University; Dr. Tadao Moriya, Fire Research Institute, Ministry of Home Affairs; MONACO - Dr. Joachim Joseph, Director, IAEA, Musee Oceanographique. PUERTO RICO - Dr. Steven S. Barnes, Nuclear Center.

Again in 1968 young science students from schools throughout the Bay Area were welcomed on tours of the NRDL facilities - about one class per month. For the fourth year, attendees at the U. C. Basic Physics Summer Institute visited the Laboratory. This group is composed of high school teachers throughout the U. S. For the second year, NRDL hosted physicians attending an American Industrial Health Conference in San Francisco. These visiting physicians are interested or engaged in industrial health programs involving radiological health problems at various laboratories and other facilities throughout the country.

CHAPTER VIII - PUBLICITY

Top news stories about NRDL during 1968 included the Change of Command ceremony on 30 August when CAPT T. R. Fick, USN, relieved CAPT D. C. Campbell, USN; the Legion of Merit award to CAPT Campbell; all other major awards; NRDL's part in Operation First Look in England; and the Cyclotron. In addition to the daily press, the NRDL Cyclotron story was depicted over KTVU-TV Channel 2 on 24 October. Also covered were Fellowships, promotions, and retirements. S. F. Chronicle columnist, Herb Caen, even mentioned our sheep, which intrigued chopper pilots around the Bay when they sighted them.

NAVAL RESEARCH REVIEWS (September 1968) carried an article by Paul Zigman, Head, Technical Management Office, titled "NRDL - The Navy's Lead Laboratory for Radionuclide Energy Systems."

LIFE MAGAZINE's photographer, Eugene Smith, on 5 September took many action shots of Robert Scheile, Head of NRDL's Precision Instrument and Glassworking Shop, for inclusion in a story on "Hand Skills".

"The NRDL Story" through slides and script was furnished to the Public Affairs Office at the 12th Naval District upon request...The Professional Council for Federal Scientists and Engineers was sent updated copy about this Laboratory and professional personnel needs for one page of a brochure on Scientific Employment Opportunities in California and Nevada.

In his Community Relations Report of 15 March 1968 to the Assistant Secretary of Defense (Public Affairs), the Chief of Information cited as an "exceptional accomplishment" the effort of NRDL to stimulate young people's interest in science.

Five members of the NRDL staff were invited judges for the San Francisco Bay Area Science Fair. In addition, 16 scientists participated in "Scientists Night" in which professional scientists and engineers attended a private showing of the Fair, 30 March, for the express purpose of discussing the various projects with the student exhibitors.

Numerous after-hour talks were presented by NRDLers to Naval Reserve Companies, at Universities, other schools, civic and church affairs.

On 12 August 1968 the Chief of Information, RADM H. L. Miller, USN, spoke at a 12ND Public Affairs Meeting at Treasure Island. Attending from NRDL were T. J. Mathews, Head of the Technical Information Division, and Helen C. "Pixie" Hicks, Head, Information Services Branch.

Mrs. Hicks was notified that she had been selected for inclusion in the directory "Foremost Women in Communications for 1969-70".

CHAPTER IX - MISCELLANEOUS

VIEWS ON EQUAL EMPLOYMENT OPPORTUNITY

Upon assuming Command of NRDL, CAPT Fick said, "As a first order item of business, I would like to confirm to all Laboratory personnel my position on the subject of Equal Employment Opportunity. Both as an individual and as a manager, I feel that we must engage with aggressive energy in actions to implement our national policy of equal opportunity in employment. For the benefit of both the individual and the organization we must initiate action to insure fairness and optimum personnel utilization. I call upon each of you to join me in working to achieve the objectives of our Equal Employment Program. Working together I am sure these objectives can be attained."

The eight-member EEO Committee, organized in June 1967, continued to play an important role in the laboratory program throughout the year. The first chairman, Mr. Charles V. Smith, was replaced in mid-year by Mr. Takeo H. Shirasawa.

COMBINED FEDERAL CAMPAIGN

$6,756 was collected in the 1968 Combined Federal Campaign conducted at NRDL from 23 September - 4 October. Eighty-two percent of the employees participated.

4TH AVOIRDUPOIS DERBY

Mr. W. Waskom, Fleet Operations Branch, won the 4th annual NRDL Avoirdupois Derby which ended on 5 February. He lost 16 pounds. During the four week contest, the 21 contestants recorded a combined loss of 91 pounds. Interestingly, Mr. Waskom continued on a high protein, low carbohydrate diet and shed another 14 pounds before June. He has maintained this "minus 30" weight since then.

"CHRISTMAS ON THE HILLTOP"

For the second year NRDLers gave generously in response to the EEO Committee's request for toys for "Christmas on the Hilltop", a party for several thousand children at the Hunters Point Housing Project. The gifts were delivered on 16 December.

SOCIAL GET-TOGETHER

Mr. William Yundt served as Chairman of the 1968 Welfare & Recreation Committee. Events included Golf (Sonoma, 26 May; Sharp Park, 6 Sept.); Bowling, 8 June; Tennis, during the Summer; Ice Follies, 7 Aug.; NRDL Night at Candlestick Park, 30 Aug.; Picnic at Angel Island, 28 Sept.; Bass Derby, 26 Oct.; Christmas Party at Treasure Island, 14 Dec. The White Elephant Sale on 17-18 Oct. brought in $93.95 and two candy sales, 11-12 April, and just prior to Christmas, netted $78.89 for the Wel & Rec.